Manfred Bölter and Benjamin Burkhard

Institut für Polarökologie der Universität Kiel, Germany

RENMAN - The Challenges of Modernity for Reindeer Management: Integration and Sustainable Development in Europe's Subarctic and Boreal Regions (an introduction to the reports of the workpackages from Kiel University)

RENMAN was an EU-funded project, which was run for 3 years from February 2001 to January 2004. It was a multidisciplinary project dedicated to follow recent and actual changes of reindeer herding in Fennoscandia (Fig. 1) by aspects of sociology, anthropology, medicine, and different disciplines of natural sciences, geography, botany, soil science, and microbiology. The project was initiated by both, scientists from the northern countries Finland, Sweden, and Norway as well as from Germany and Sámi reindeer herders. The project encountered in total 10 partners.

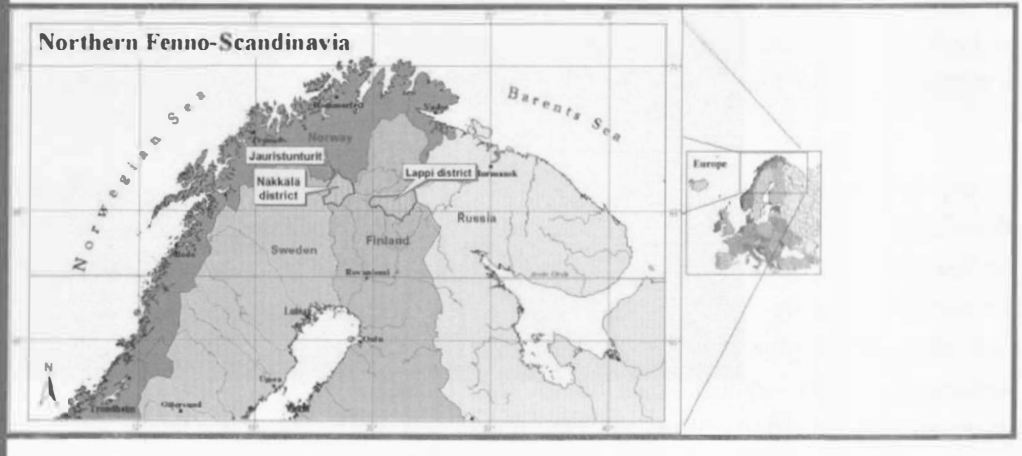

Figure 1 *Study Sites of the RENMAN project*

The final aim was to establish a management plan for changing herding in the changing natural, sociological, and political environment. Those changes occur from social shifts and demands, changing environmental properties from global and local impacts, competitions for land uses, and its consequences for traditional livings. These interferences end up in changes of people's stile of living and in environmental changes. Descriptions of the latter ones was the task of the Workpackages 9, and an overall analysis and modelling by Workpackage 5.

Reindeer grazing can be expected to change soil properties. These effects will not be restricted to one component of an ecosystem alone, *e.g.* plants, but will influence all other compartments as well, *e.g.*, physics, soil chemistry, soil microbiology. The primary objectives for WPs 9 of the project RENMAN were

established to describe actual states of soil physical properties, soil chemistry, soil microbiology and to document the hygienic status of reindeer pastures and surface waters under different herding strategies.

These work packages were formed by namely 4 institutions from Kiel University: The Institute for Hygiene and Environmental Medicine (Prof. Dr. Christiane Höller), the Institute for Plant Nutrition and Soil Science (Prof. Dr. Rainer Horn), and the Institute for Polar Ecology (Prof. Dr. Manfred Bölter); the Ecology Centre (Dr. Felix Müller) represents Workpackage 5, which aimed at the establishment of models combining data from the individual disciplines. Soil chemical analyses were performed by WP10, the Norwegian Crop Research Institute, Holt Research Centre, Tromsö (Dr. Christian Uhlig).

Main objectives

(WPs 9.0 – 9.2)

- to evaluate thresholds for different microbial organisms with respect to risk assessments and turnover of organic matter (WP 9.0);
- to estimate the relative importance of changes in structure on structure and dynamics of soils during changes of land-use (WP 9.1);
- to evaluate characteristics of changing soil patterns with respect to their behaviour under environmental stress, e.g., erosion, freeze-thaw (WP 9.1);
- to evaluate critical parameters for soil stability (WP 9.1);
- to describe soils as possible sources of pathogens (WP 9.2);
- to examine life and survival strategies of different pathogens and their infection potential (WP 9.2).

The individual workpackages were coordinated for common field studies and workshops (Tab. 1). Key issues were common samplings during the field experiments and the excursions with herders and representatives of the communities Vuotso and Näkkälä (Fig. 1). The field sites were close to the town Vuotso and the village Näkkälä in northern Finland. Vuotso is in a forest region and reindeer herding is in strong competition to forestry, tourism and hydro power. Näkkälä is located close to the Norwegian border and mainly a fjell region without those strong pressures as in Vuotso.

The samplings had different strategies with respect to the objects under investigation. Soil samples were taken during both the wet and dry locations in order to describe changing patterns of hydraulic properties, the changes in nutrient conditions and analyses of pore systems, which function as preferred niches for microbes. During spring we intended to determine effects of thawing and enhanced stress of trampling and input and fate of wastes during this season, in comparison to dry summer conditions. Aspects of nutrient leaching and accumulation under these conditions were compared in relation to changes of the microbial communities.

Table 1 *Dates of field studies and workshops in Finland*

Destination	Period
Näkkälä (Finland, Norway)	18.06. - 01.07.2001
Vuotso (Finland)	16.08. - 28.08.2001
Kiruna (Sweden), Rovaniemi, Oulu (Finland)	05.03. - 31.03.2002
Vuotso (Finland), Näkkälä (Finland, Norway)	07.06. - 27.06.2002
Näkkälä (Finland, Norway)	17.08. - 10.09.2002
Rovaniemi, Saariselkä, Inari, Sodankylä (Finland)	15.02. - 22.02.2003
Näkkälä (Finland, Norway)	30.05. - 10.06.2003
Saariselkä (Finland), Näkkälä (Finland, Norway)	20.08. - 08.09.2003
Rovaniemi (Finland)	23.11. - 02.12.2003

Samples with respect to faecal indicators and human pathogens needed to be processed as soon as possible after sampling. Reindeer faeces were examined during the whole study and from various places. They derived from faecal pellets as well as from intestine samples taken in slaughter houses. To obtain a representative picture of the epidemiological situation it was necessary to investigate not only a large number of animals but also a couple of different herds. The age distributions were of interest too, as disparities often exist between young and old animals. This study of animal faeces needed to be conducted during different seasons as the excretion of pathogens often follows a seasonal pattern.

Severe human infections and/or resistance against water treatment steps have led in other regions to growing concerns, especially when surface water is used as a drinking water source. Survival of enteric bacteria in the soil environment may be decreased by several factors, but the extent of this kind of contamination will be investigated in another part of the study. Because it is impossible to examine for all conceivable pathogens, the focus on the determination of faecal indicators will give a general impression of the situation and these organisms

Roundup in Näkkälä

may serve as a model for soil management plans.

Data interpretation is still preliminary. Not all linkages to other parameters have been identified so far; this analysis is a continuing progress and needs the completion of our data base. Hence, more information from other projects is needed and under evaluation.